

Toko For Technology



COMPANY'S OUTLINES

TOKO INC., since its establishment in 1956, has specialized in the production of miniature radio components, notably the IF transformers and oscillator coils. In step with the growth of the transistor radio industry, TOKO has developed and manufactured the coils in over-increasing numbers. It is now stepping up deliveries to 10,000,000 units monthly to satisfied customers, both domestic and overseas. In fact, only TOKO coils are specified by all leading design engineers to achieve superior performance. It supplies practically all of the demands for the domestic market, and exports large quantities to manufacturers all over the world. The company is proud that it is the world's largest manufacturer of these items.

In addition to coil, TOKO manufactures other components for small radio, such as ceramic variable capacitors and trimmers, and the new integrated IF amplifier block with a ceramic filter.

In the computer field, TOKO has developed the high-density woven wire memory planes for high speed operation, utilizing thin-film techniques. Other products include the Wiretron - a high speed Parametron logic element, pulse transformers, and delay lines, etc.

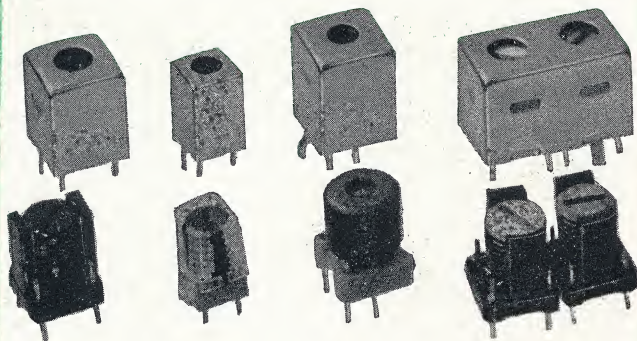
This leaflet describes in brief the various products made by TOKO. Inquiries are invited on the specific items.



TOKO INC.

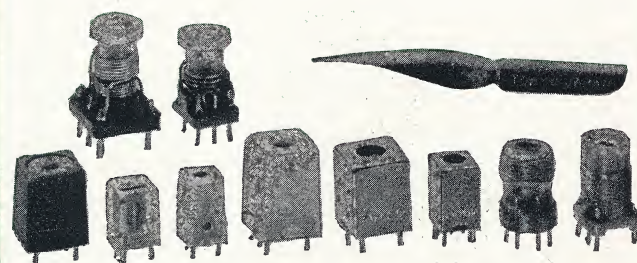
Formerly Toko Radio Coil Laboratories Ltd.

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Telephone : (727) 1161—79
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Telex : "RADICOIL" TK 2696



IF TRANSFORMERS

Over 300,000,000 IF transformers made by TOKO are in miniature radios and TV receiving sets all over the world. Specified by all leading design engineers when the equipments' performance is paramount. Available in 10mm ($\frac{3}{8}$ in.) and 7mm ($\frac{1}{4}$ in.) sizes for AM, FM, and TV sets.

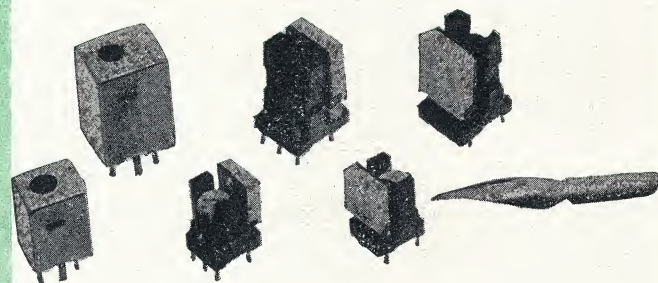


OSCILLATOR COILS

For use in conjunction with the famous TOKO IF transformers for the optimum conditions in set performance. Unique in design and made in both shielded and open styles. Temperature compensated ferrite cores used for stability.

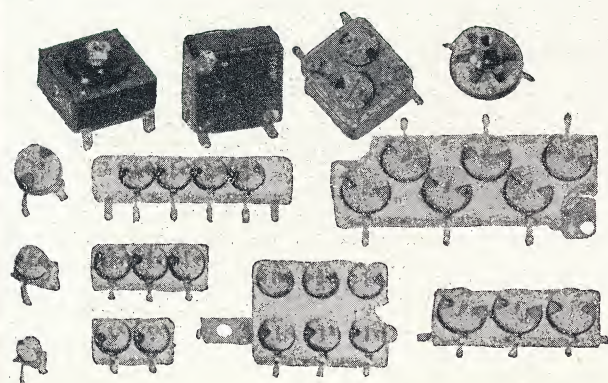
H-TYPE MECHANICAL FILTERS

An economical miniature mechanical filter for 455 kc, or 262 kc, made up of a stamped alloy in shape of the letter "H". Piezoelectric elements are used for transducers. Designed specially for broadcast type transistor radio receivers. Enclosed in shield with matching transformer.



CERAMIC VARIABLE CAPACITORS AND TRIMMERS

Compact 2-gang units, with and without trimmers, for AM superhets using 455 kc IF. Low tracking error, non-microphonic and long operating life. Size only 15×15×11.5mm (.59×.59×.45 in.). Miniature round trimmers, both single and multiple unit types, for minimum space requirements. Maximum capacitance, 50 pF, approximately.

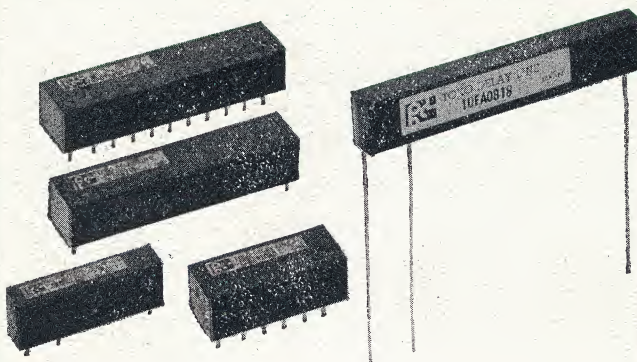


DELAY LINES

Small, compact, and high quality units, available in three sizes, with and without taps. Lumped constant type, internally shielded, with high Q and low attenuation properties.

TYPE	Length	Width	Height	Taps,% of total time delay
5B Series	52mm(2.05')	12mm(.473')	17mm(.67')	none
10BT Series	50mm(1.97')	20mm(.78')	17mm(.67')	20, 40, 60, 80
20B Series	87mm(3.42')	17mm(.67')	17mm(.67')	none
20BT Series	88mm(3.5')	20mm(.78')	17mm(.67')	10, 20, 30, 40, 50, 60, 70, 80, 90

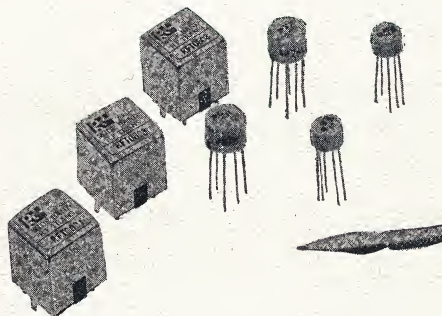
For color TV circuits, a special miniature type, the F Series, has been developed with a delay time of $0.8\mu\text{S}$, and rise time of $0.2\mu\text{S}$. Size is only $60 \times 10 \times 8\text{ mm}$ ($2\frac{3}{8} \times \frac{3}{8} \times \frac{5}{16}\text{ in.}$ approx).



PULSE TRANSFORMERS

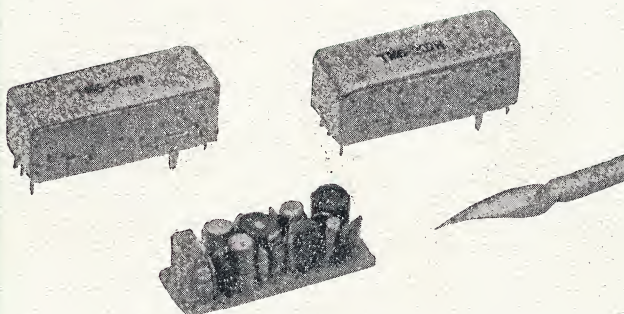
Designed for high performance characteristics. Small and suited for use in modern high speed circuitry required for high speed computers. Available in two sizes, for various impedances, pulse widths, rise times and bandwidths, and for printed circuit board mounting.

TYPE	Diameter	Height
PB	9mm (.36")	6mm (.24")
PC	11.5mm (.45")	8.5mm (.34")



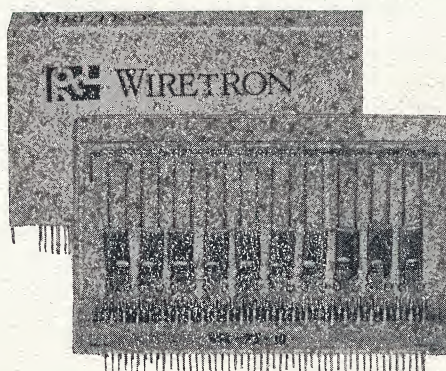
IF BLOCK (with 455 kc CERAMIC FILTER)

TOKO's latest contribution to transistor radio set design - the integrated unit containing the complete IF amplifier circuitry, including two transistors and one diode. Simplifies set design and assembly, no adjustments required; reduces stock control expenses, 1 unit in place of 21 separate components. Compact, only 6.9 c.c. (0.42 cu. in.). Fully shielded, uniformity in production for gain and selectivity characteristics.



WIRETRON

This is a form of a Parametron logical unit, which features minute dimensions, high speed operation, and high reliability for electronic computers and automatic control equipment. The WIRETRON utilizes the superb characteristics of a ferromagnetic thin-film wire. It will operate at speeds unattained by ferrite-cored units and at lower power requirements. Maximum exciting frequency is 20 Mc and the clock frequency 300 kc or lower.



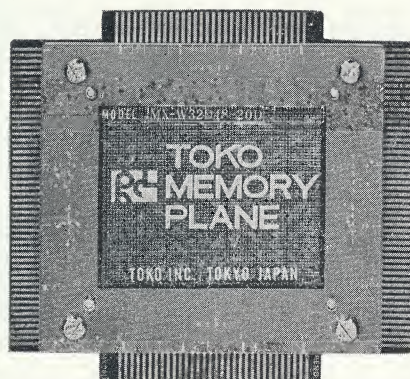


Fig. 1. 4,096-BIT MEMORY PLANE

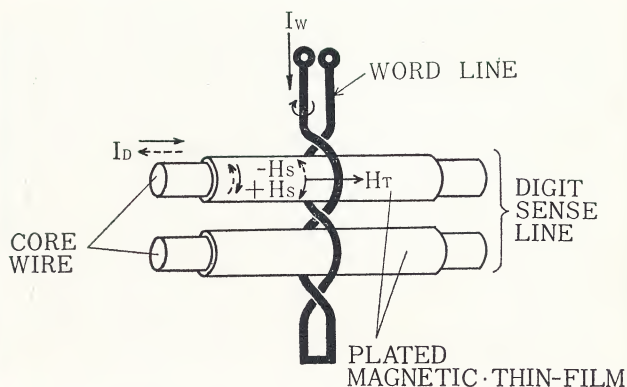


Fig. 2. BASIC WEAVE

TOKO MEMORY PLANE

At the IEEE Show of 1963 in New York, TOKO's woven memory matrix was introduced. It stirred quite an interest in this form of the memory plane because of the great possibilities ahead.

Continued work on the planes has resulted in great improvements in the dynamic properties. The plating processes, test procedures, and special weaving methods and machines were developed to produce the most reproducible and uniform memories of the highest reliability.

Basically, the TOKO memory plane is a high density weave of two conductors, the digit-sense and word lines. The intersections form the bits, a large number of which can be woven in a small area by using fine wires. As a matter of interest, the weave containing 4,096 bits is only 64×64 mm ($2\frac{1}{2} \times 2\frac{1}{2}$ in.), and certainly belongs in the high density class. The actual size of the completed unit is much larger on account of the terminal connections. (Fig. 1)

The principle of fabrication is shown in Fig. 2. The digit-sense lines consist of a conductor plated with a thin film, about 2 microns, of magnetic material having square loop characteristics. The digit, or information, current flowing in the wire will produce a magnetization in the circumferential direction. A word drive current

in the insulated wire will magnetize the digit line at right angles to the easy axis, and the B-H characteristics are altered, and the signal is stored. At the readout, the output voltage polarity will depend on the initial magnetization, and used as 1 or 0, accordingly.

The "coupling" between the digit and word lines is made quite close by the use of two pairs of wires for the word drive. This is effective in producing a more intense magnetization of the bit, which in turn reduces the effects of disturbance from the adjacent bits. It has been found experimentally that the bit is highly resistant to disturbs, a characteristic very necessary for dependable operation.

In operation, typical parameters are:

Word Drive, I_w 400mA
 Digit Drive, I_d 50mA
 Output Voltage 10mV, min.
 (T_r of $I_w = 50$ nS)

A switching time of 20nS, approx., can be achieved with I_w of 20nS or less.

In addition to DRO operation, recent studies have indicated that NDRO operation is possible and TOKO anticipates a big step forward into this area.



TOKO INC.

RCL-6319A

TOKO MEMORY PLANE

MEASUREMENT OF CHARACTERISTICS

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TOKO MEMORY PLANE

Measurement of Characteristics

The structure of the TOKO Memory Plane is shown in Fig. 1.

The plated thin-film wires, shown in the horizontal direction, are the digit, or sense, lines with the insulated wires (vertical direction) for the word drive lines. In this figure, one crossover point (within the dotted circle) represents one bit. The word drive current is fed into the terminal W_1 and the digit drive current is applied between the terminals 2 and 2'. This constitutes the normal method of operation.

When several digit lines are connected in series or in parallel, the output signal can be increased. Furthermore, when the series connection is used, the following effect is achieved.

For example, by shorting the digit terminals 1' and 2', and making the digit current flow from terminals 1 to 2, the noise is greatly reduced. In addition, 2 bits will take the place of 1 bit, resulting in the doubling of the sense output signal.

An example of a test pulse pattern is shown in Fig. 2. I_w is the word drive current and I_D

is the digit current. At point "a", the sense output is observed just after the write-in. At point "b" the output is observed after 1, 2, ... n disturbances have been added. The sense signal output will depend on the magnitude of I_w and I_D . Again, the rise time of I_w will cause variations in the output and switching time.

The standard test pulse and the switching time are shown in Fig. 3. In Fig. 4, the positive

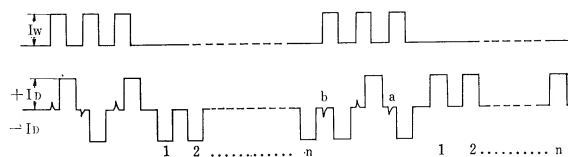


Fig. 2 Pulse Pattern

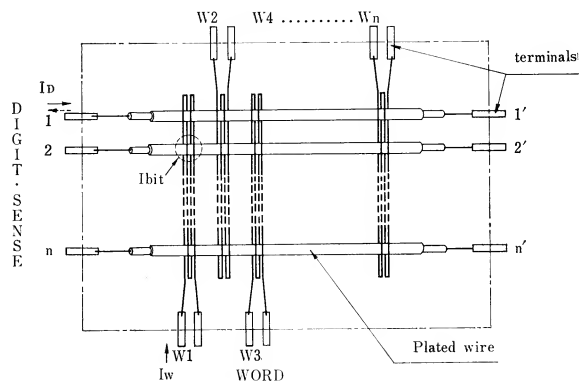


Fig. 1 Structure of TOKO Memory Plane

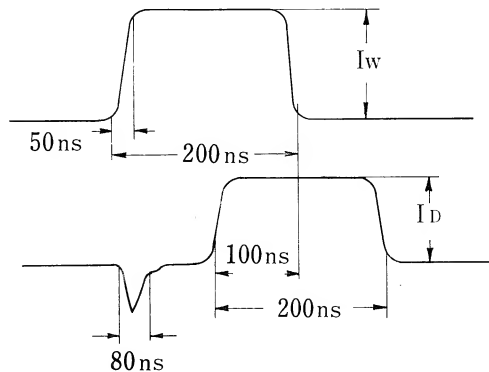


Fig. 3 Standard test pulse and switching time

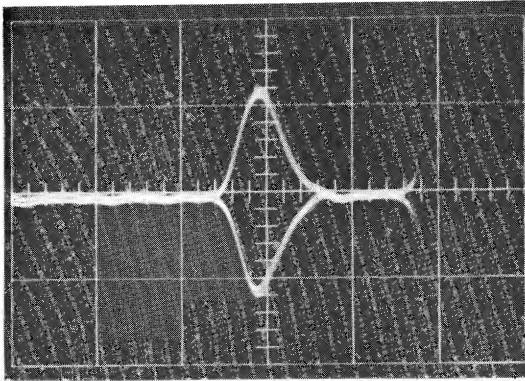


Fig. 4. Out Put Signal($\pm 12\text{mV}$)

and negative sense output signals are observed simultaneously and the noise is practically absent. Thus, the signal to noise ratio, S/N, is very excellent, and furthermore, the lowering of the output due to disturbance is negligible.

The measuring circuit for obtaining the fore-mentioned data is shown in Fig. 5. A load impedance of 100 ohms is shown but this value is determined by the input impedance of the sense amplifier. The resistor in series with digit line is for checking the digit current.

A few pointers will be described which will be found useful in the tests for the characteristics.

By having the word drive currents, I_w , flow

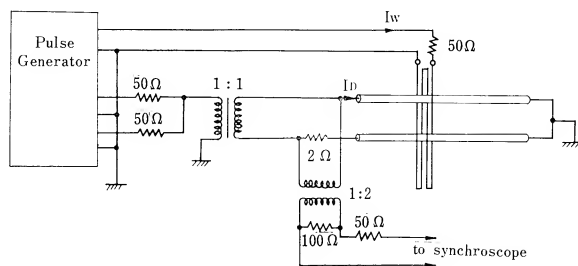


Fig. 5 Measuring circuit Diagram

in the opposite directions over the same plated wires, and the direction of the driving magnetic field in reverse, the effect of interference between the adjacent bits will be greatly reduced.

The digit line behaves as a magnetic closed circuit with respect' to the write-in. Again, this crosses directly over the word drive line, and the noise due to the driving field is practically negligible.

However, since both lines are in very close contact, the mutual capacitances are relatively large, there being about 6 to 7 pf per bit. Thus, when measurements are taken as per Fig. 6, a part of the word drive current will flow into the digit line through the stray capacitance, C , and becomes a source of noise.

To offset this effect, methods shown in Figs. 7 and 8 can be used.

A pulse transformer is connected to the word drive line in the circuit of Fig. 7. The use of a balanced transformer with the grounded center-tap is recommended.

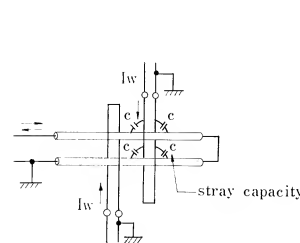


Fig. 6

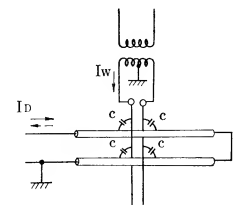
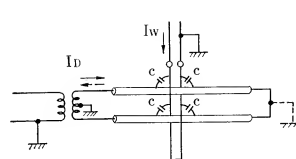


Fig. 7



(A)

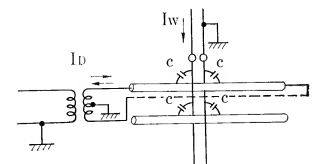


Fig. 8

(B)



In Fig. 8, (A) and (B), a pulse transformer is connected in the digit line. When the digit line is used in a "round-trip" fashion, Fig. 8 (A), the sense output is doubled as mentioned previously. By this method, the pulse transformer can be used either to "float" the word drive circuit from the ground or to ground the center-tap of a balanced transformer.

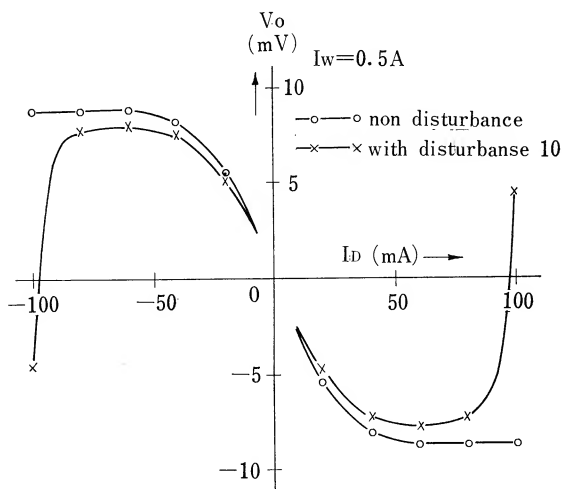


Fig. 9 I_D - V_o (when $I_w=0.5A$ constant)

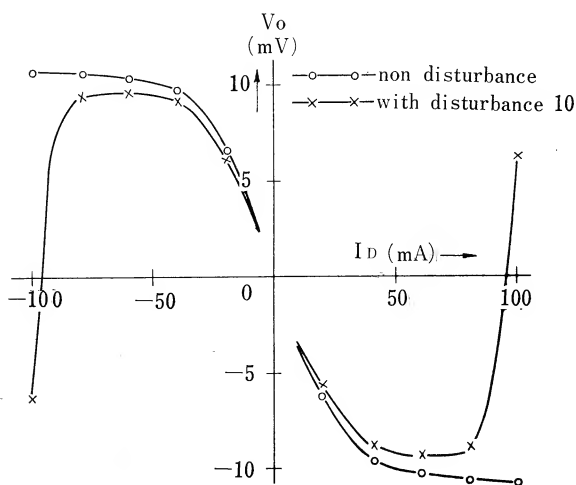


Fig.10 I_D - V_o (when $I_w=0.8A$ constant)

In the former case, by grounding the shorted terminals (dashed lines) of the digit lines as shown in the figure, a nearly identical mode with the latter is achieved.

Furthermore, by using a somewhat similar method, Fig. 8 (B), the case where a grounded center-tap pulse transformer having an impedance higher than the single digit line to which it is connected, is shown. This results in the cancellation of noise currents.

The results of a typical test will be given.

Fig. 9: Relationship between Output Voltage, V_o , and digit drive current, I_D , for a write drive current $I_w = 0.5 A$.

Fig. 10: Same as Fig. 9, but with $I_w = 0.8 A$

Fig. 11: Relationship between I_w and V_o for digit drive current, $I_D = 50 mA$.

When the digit drive current, I_D , is greater than 50 mA, there may be an unbalance or reduction in amplitude of the output signal and care must be exercised.

It is preferable to employ I_D of less than 50 mA to be on the safe side.

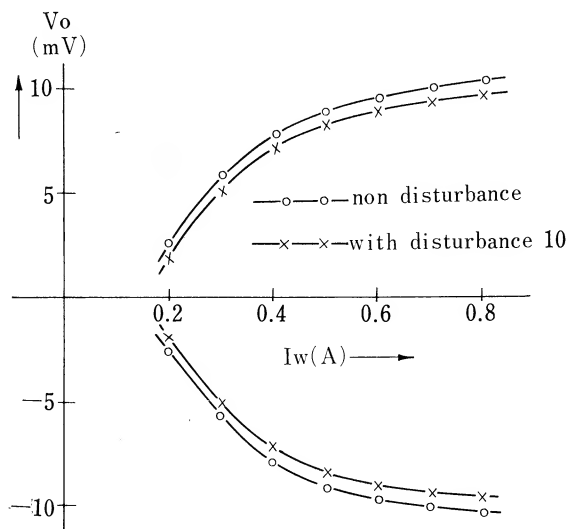


Fig.11 I_w - V_o (when $I_D=50mA$ constant)



TOKO MEMORY PLANE

Tests With the CTC Plane Tester

Foreword

The TOKO Memory Planes are being tested by the various electronic computer manufacturers for the static characteristics from different standpoints. It has been found that the results are very similar to those obtained in our company laboratories.

We are always continuing our search for the most satisfactory methods for testing dynamically the memory planes which correspond to the actual working conditions wherein the planes are built into the computers. The dynamic tests are very important and in our laboratories, we are nearing the completion of a small system for this purpose.

We have acquired the Memory Plane Tester Model 2151A, made by the Computer Test Corporation (USA), recently, which permits the dynamic testing of memory planes under very nearly the same operating conditions as met with in practice. The results obtained were very satisfactory and these will be described in this report.

The CTC Model 2151A Tester is designed for core memory testing, but with care in operation, it can be used for tests on the TOKO Memory Planes, which are the thin-film type.

The TOKO Memory Plane has the common operation of the sense line and the digit drive line. Therefore, a pulse transformer can be inserted in either line. This procedure eliminates the noises due to the stray capacitances as described in the TOKO Reports RCL-6319. Following this method, a center-tapped pulse transformer was inserted between the terminals of the digit lines. Since the sense amplifier in the said Plane Tester was of differential type, the secondary of the pulse transformer was connected to this amplifier.

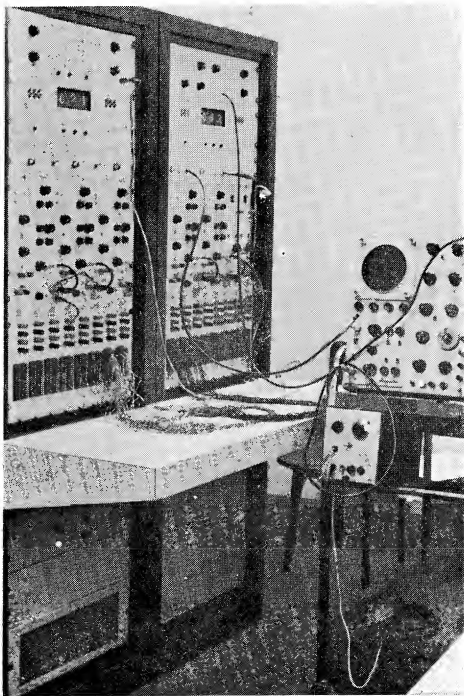


PLATE. 1
C. T. C Memory Plane Tester 2151 in Use



PLATE. 2
Memory Plane Under Test



The following results were obtained using the above method.

1. Relation between Word Drive and Digit Drive Currents.

The rise time used was $0.15\mu\text{s}$. It was found that as the rise time of the word drive current was lowered, there was a tendency of this current to distort its waveform.

Fig. 1 shows the waveforms of the word and digit pulses.

2. Tests on the W26D50-20D, (No. 304Y).

(A) In Fig. 2, the word lines were switched automatically with respect to the digit lines 16, 17 and 24, and the minimum values of each bit from 0 to 25 (total 26 bits) were plotted. In other words, these show the uniformity of the memory output of the plated wire formed by the respective digit lines.

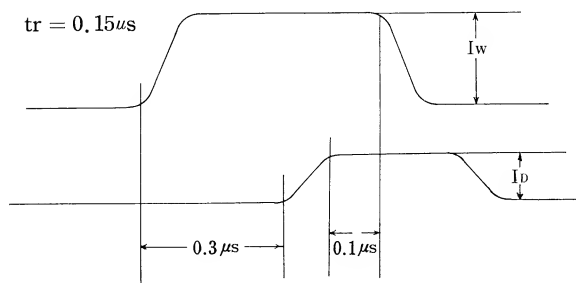


Fig.1 Word and Digit Pulses:

tr : rise time
Iw : word drive current
ID : digit drive current

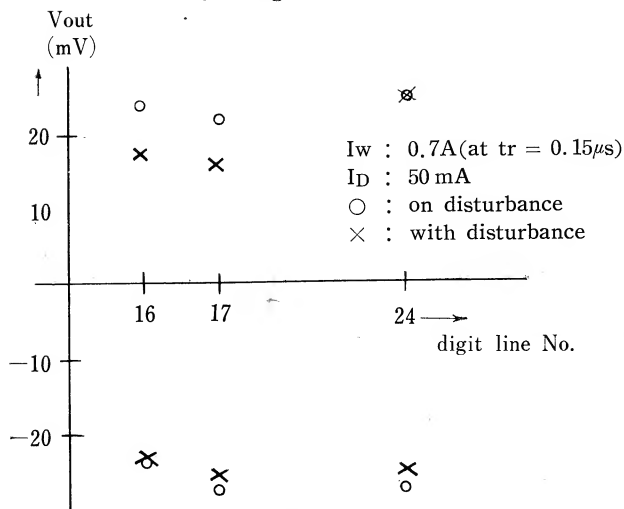


Fig.2 Uniformity of Output
(Minimum outputs of word lines, 0-25)

The symbol $\circ$ indicates the output voltage read out immediately after the write-in. The symbol $\times$ indicates the output of the bit written in with a given information on which a disturbance pulse of the same magnitude as the write-in current but from the opposite direction has been applied, and read out. In the tests of Fig. 2, the word drive currents of each adjacent bit were of the same polarity.

(B) Figures 3 and 4 show the results when the word drive currents are applied so that the magnetic exciting field in each adjacent bit is mutually in the opposite directions.

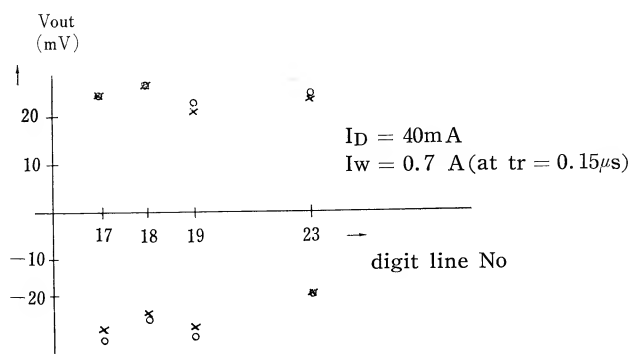


Fig.3 Effect of Interference

Word lines 0~25 at minimum output

$\circ$: 1 write-in, both sides
 $\times$: 20 write-ins, both sides

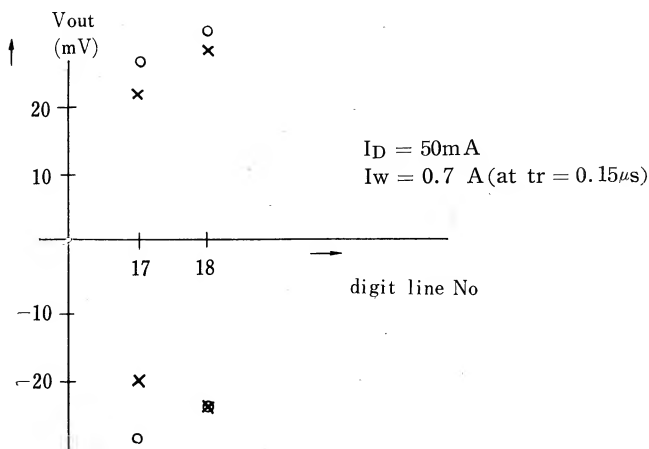


Fig.4 Effect of Interference

Word lines 0~25 at minimum output

$\circ$: 1 write-in, both sides
 $\times$: 20 write-ins, both sides

As can be noted, when this particular memory plane was operated with a drive current of 40 mA, the difference due to the number of times the adjacent bit is written in is, that for the first and the 20th write-ins, the same values were obtained. From this, it can be seen that the effect of the number of write-ins on the adjacent bit is fixed by the first write-in, and there are no effects after the second write-in.

3. Tests on the W50D50, (No. 355Y).

Since good performance was achieved on the previous memory plane, No. 304Y, which had a word line separation of 2 mm, the above captioned unit was tested. This was made with a word line separation of only 1 mm.

(A) Effect of Disturbances.

A disturbance having a pulse pattern shown in Fig. 5 was used in the tests. The output was 39mV/2bit, whether the disturbance was present or not, and the performance was considered excellent. On the memory plane used, taking up the same digit lines, each adjacent bit is a continuation of the magnetic

thin-film and the magnetic field due to each word current is distributed approximately in parallel with the digit line. The following tests were devised taking into consideration that interference may arise due to this condition.

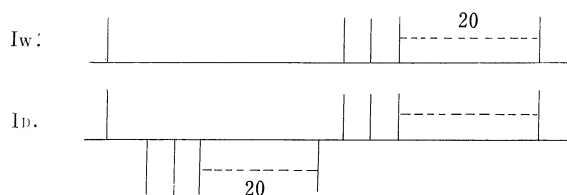


Fig. 5 Pulse Pattern of Disturbance

(B) Other Tests.

The pulse pattern used is shown Fig. 6. After several dozen write-ins on all the bits, positive or negative, on 1 digit line, 1 write-in is performed on the bit under test from the opposite direction. Continuing, when the adjacent bit has been written in several dozen times, and if the content of

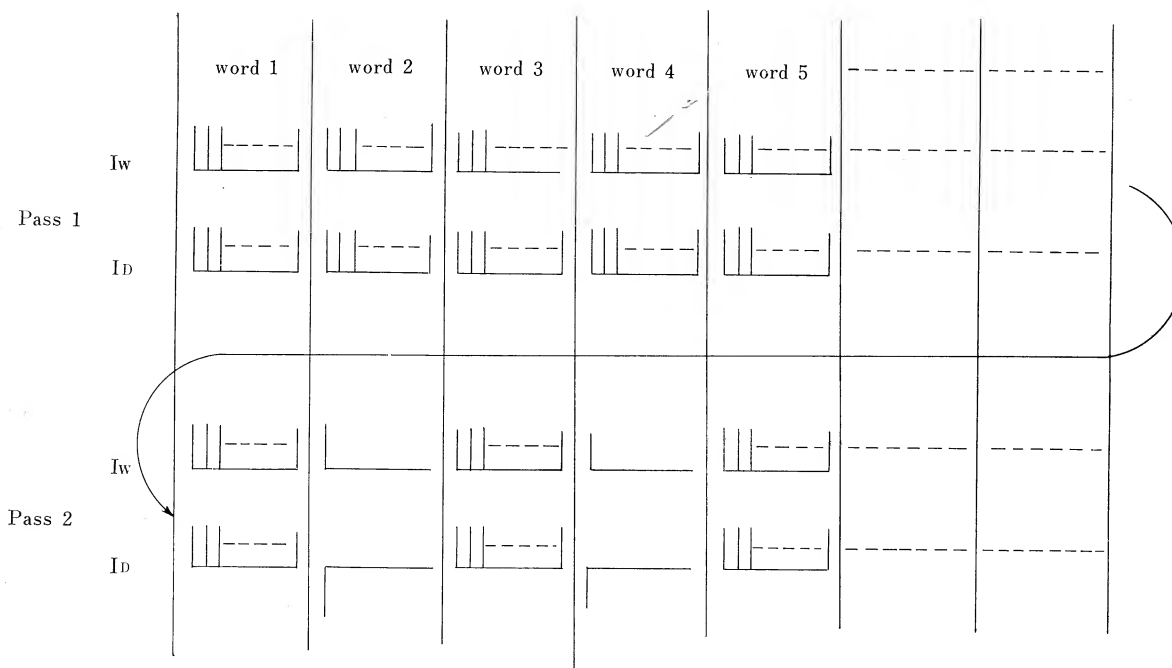


Fig. 6 Pulse Pattern



the point under test is not mutilated by the digit current, then the unit can be considered as satisfactory. Fig.7 shows the results of these tests.

When the write-in on the adjacent bit is done once, 20 or say 96 times, the normal output and direction is indicated.

Again, an output between 15.5 and 16.0 mV was obtained when the word and the drive currents were varied between $\pm 15\%$. These figures are believed to be within the limits of experimental errors, and speak well for the uniformity of each bit.

As can be gathered from the results, the output from the 1mm separation memory plane is somewhat less than that of the 2mm separation type.

4. Tests on the W32D50-20D, (No. 376Y.)

The word drive current was varied in this test, keeping the pulse pattern the same as shown in Fig. 6. Fig.8 shows the results. The figure shows the lowest values of the observed output from each bit, the digit lines were Nos.4 through 14 and all the 32 words were tested. The word drive currents were 0.7A, 0.5A, and 0.4A, and the figure shows that the proper operation was achieved with these currents.

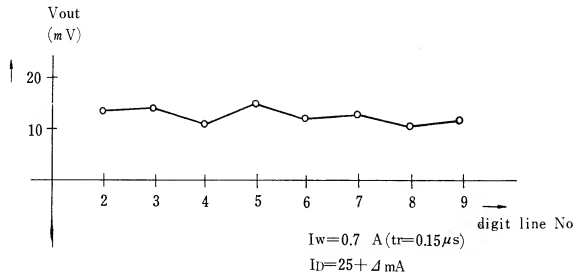


Fig.7 Interference Tests
Word lines 0~31 at minimum output
20 write-ins both sides

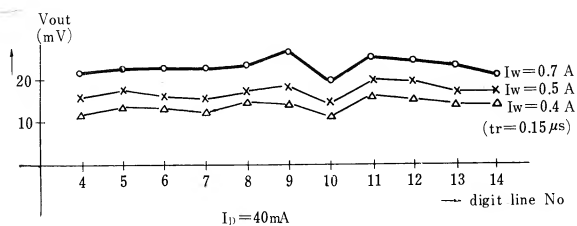


Fig.8 Interference Test
Word lines 0~31 at minimum output
20 write-ins both sides

Summary

The static tests performed in the laboratories, for instance, in TOKO Report RCL-6319, the load impedance used for the sense circuits is $25\ \Omega$, and the output is based accordingly. In the sense amplifier of the Model 2151A, the input impedance is $100\ \Omega$, but even then with the word drive current of 0.7A and a rise of $0.15\ \mu s$, a 20 mV output is available. This makes it very convenient to build up the circuits associated with the TOKO Memory Plane.

TOKO INC.

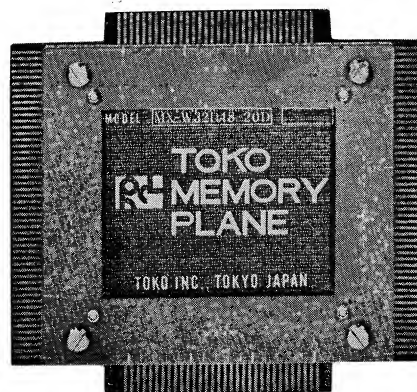
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TOKO MEMORY PLANE (A High Speed Thin-Film Wire Memory Matrix)



MODEL MX-W32D48-20D

The TOKO Memory Plane is a magnetic memory matrix for application in electronic computers and automatic control equipment.

It is destructive and non-destructive readout memory element, operating on the word selection system and features high speed, high output, operation over wide temperature ranges, compactness

and lightness.

Its construction consists of magnetic thin-film wire employed for the direct writing and readout lines, and an insulated wire for the word drive line. The two types of wires are woven to form a wire mesh matrix.

1. Typical Operating Parameters

MODEL		MX-W32-D48-20D	MX-W-50-D48-100 MX-W-64-D64-100
Word drive current,	I_w	400 mA	400 mA
Digit write current,	I_D	50 mA $\pm$ 10%	50 mA $\pm$ 10%
Output voltage,	V_o	10 mV, min. (Note 1 & 2)	4 mV, min. (Note 1 & 2)

Notes: 1. with rise time of I_w of 50 nS.

2. higher output voltages obtainable with faster rise times.

2. Switching time is 20 nS approximately.

This can be achieved with a word drive current, I_w , rise time of 20 nS or less.

3. Signal to noise ratio, S/N. 30 dB approximately

4. Read-Write cycle time: 100 nS to 10 μ S.
(less than 100 nS in small memory systems).

5. Operating Temperatures: from -60° to +150°C

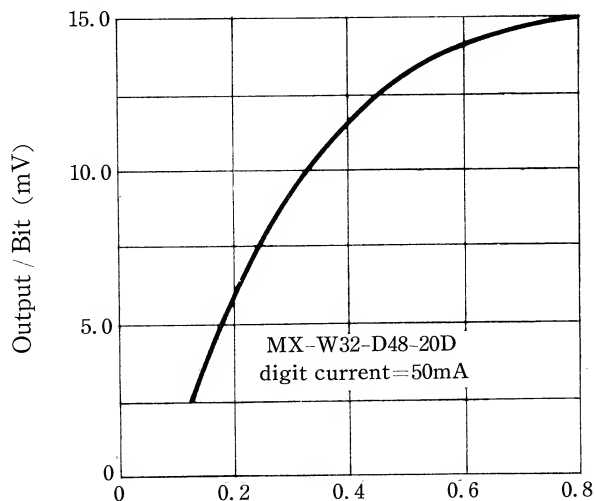
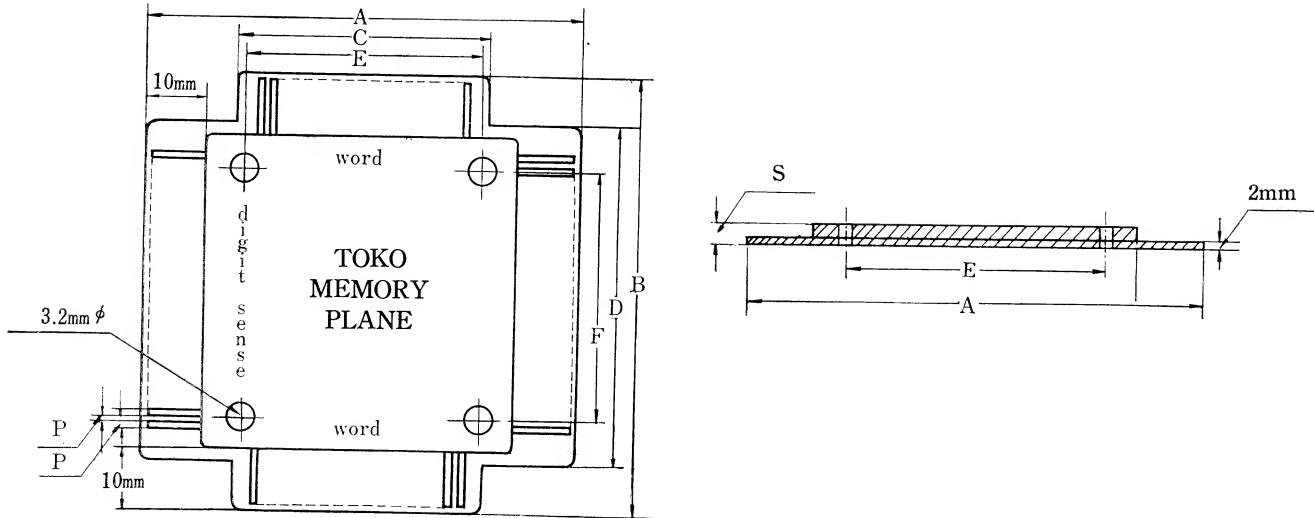


Fig 2 Word Current (A)



TOKO INC.

RCL-6326 A



MODEL	Total Bit Number	Dimensions (mm)							
		A	B	C	D	E	F	S	P
MX-W32D48-20D	1,536	133	123	73	103	90	85	6	1
MX-W50D48-10D	2,400	124	140	103	103	70	80	6	1
MX-W64D64-10D	4,096	120	130	120	130	92	92	6	0.5
※ MX-W32D40-20N	1,280	127	108	78	92	77	70	4.5	0.039"

※ Sample available for test purposes only.

Nomenclature:

(a b c d e f g h)
MX - W 32 D 48 - 2 0 D

- a : TOKO Memory Plane symbol
- b : symbol for word drive lines
- c : number of words or word drive lines
- d : symbol for digit lines
- e : number of bits per word or digit lines
- f : indicates gap in mm between word drive lines
- g : symbol for MODEL of spacer used between drive lines
- h : symbol for operating mode
- D: destructive readout type
- N: non-destructive readout type

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